Astrophysics > High Energy Astrophysical Phenomena

Comparing the Accretion Disk Evolution of Black Hole and Neutron Star X-ray Binaries from Low to Super-Eddington Luminosity

Shan-Shan Weng, Shuang-Nan Zhang

(Submitted on 26 Jul 2011)

Low-mass X-ray binaries (LMXBs) are systems in which a low-mass companion transfers mass via Roche-lobe overflow onto a black hole (BH) or a weakly magnetized neutron star (NS). It is believed that both the solid surface and the magnetic field of an NS can affect the accretion flow and show some observable effects. Using the disk emission dominant data, we compare the disk evolution of the two types of systems from low luminosity to super-Eddington luminosity. As the luminosity decreases the disk in the NS LMXB 4U1608--522 begins to leave the innermost stable circular orbit (ISCO) at much higher luminosity ($\sim$ 0.1 L_{Edd}), compared with BH LMXBs at much lower luminosity ($\sim$ 0.03 L_{Edd}), due to the interaction between the NS magnetosphere and accretion flow. However, as the luminosity increases above a critical luminosity, the disks in BH and NS LMXBs trace the same evolutionary pattern, because the magnetosphere is restricted inside ISCO, and then both the NS surface emission and (dipole) magnetic field do not significantly affect the secular evolution of the accretion disk, that is driven by the increased radiation pressure in the inner region. We further suggest that the NS surface emission provides additional information of accretion disk, not available in BH systems. Through the observed NS surface emission, we argue that the disk thickness H/R is less than $0.3-0.4$, and that the significant outflow from inner disk edge exists at luminosity close to Eddington luminosity.

Comments: 17 pages, 5 figures, 1 table, accepted for publication in ApJ
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**
Cite as: **arXiv:1107.5171 [astro-ph.HE]**
(or **arXiv:1107.5171v1 [astro-ph.HE]** for this version)

Submission history

From: Shan-Shan Weng [view email]

[v1] Tue, 26 Jul 2011 11:17:14 GMT (68kb)

Which authors of this paper are endorsers?